中国科学院
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# CASNewsletter

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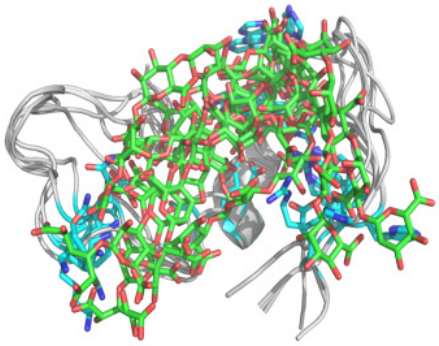
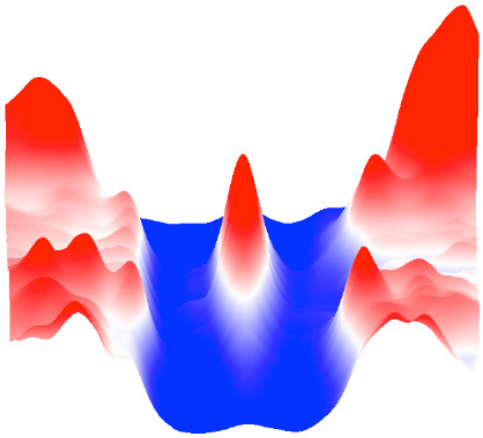
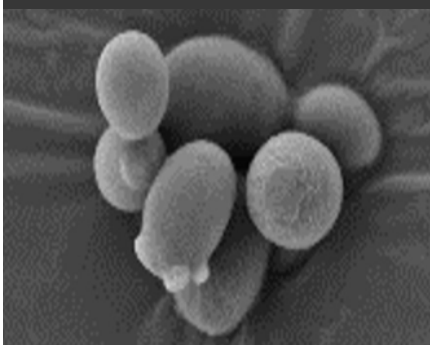
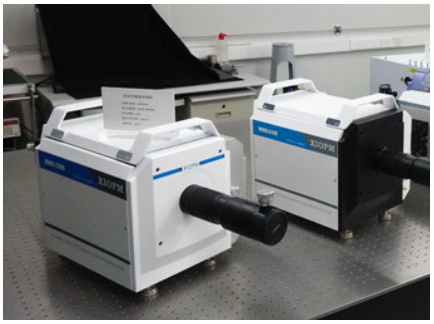
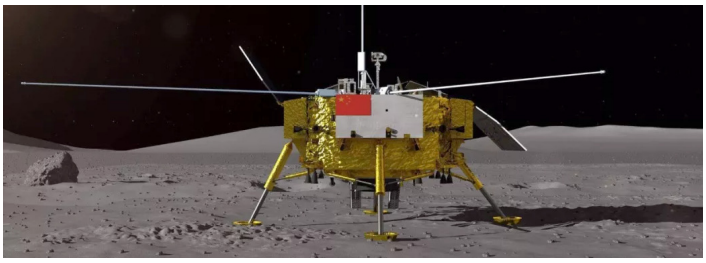


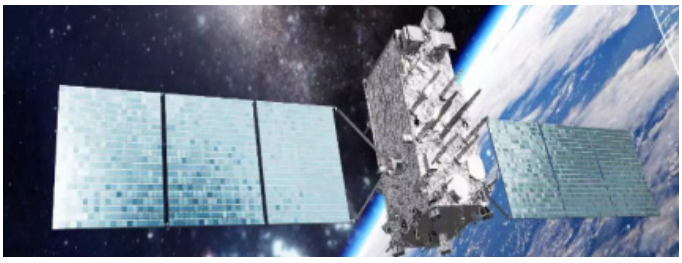



## Highlight Researches in CAS 2018







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# Strong support for Chang'e-4 moon landing mission

Chang'e-4 lander

*Credit: National Astronomical Observatory*
*National Space Science Center*
*Shanghai Astronomical Observatory*
*Shanghai Institute of Technical Physics*
*Hefei Institutes of Physical Sciences*
*Shanghai Institute of Optics and Fine Mechanics*

The Chinese Academy of Sciences (CAS) accomplished several key tasks for the Chang'e-4 mission as one of three core organizations involved in the project. The Ground Research and Application System (GRAS), which handles data acquisition, processing, management and coordination of scientific applications, was developed by the National Astronomical Observatory of CAS. Most of the payloads for the Chang'e-4 lander and rover were developed by CAS. Furthermore, CAS's National Space Science Center is responsible for the overall management of the Chang'e-4 payload subsystem. The Very Long Baseline Interferometry (VLBI) orbital measurement was organized and accomplished by the Shanghai Astronomical Observatory of CAS. Altogether, over 20 critical instruments and materials crucial to Chang'e-4's safe landing, ongoing operation on the lunar surface and scientific exploration were developed by CAS institutes, including the Shanghai Institute of Technical Physics, the Hefei Institutes of Physical Sciences and the Shanghai Institute of Optics and Fine Mechanics.

# Macaque monkeys cloned by somatic cell nuclear transfer

*Credit: Institute of Neuroscience*

A research team at the Institute of Neuroscience Center for Excellence in Brain Science and Intelligence Technology, Chinese Academy of Sciences, achieved a technical milestone in non-human primate cloning by generating two genetically identical long-tailed macaque monkeys using somatic cell nuclear transfer. The cloned monkeys were named Zhong Zhong and Hua Hua after the Chinese word "Zhōnghuá," which means "Chinese nation or people." Zhong Zhong was born on Nov 27, 2017, while Hua Hua was born on Dec 5, 2017. This work was published as a cover story in the journal *Cell* on Feb 8, 2018.

**Zhong Zhong and Hua Hua**

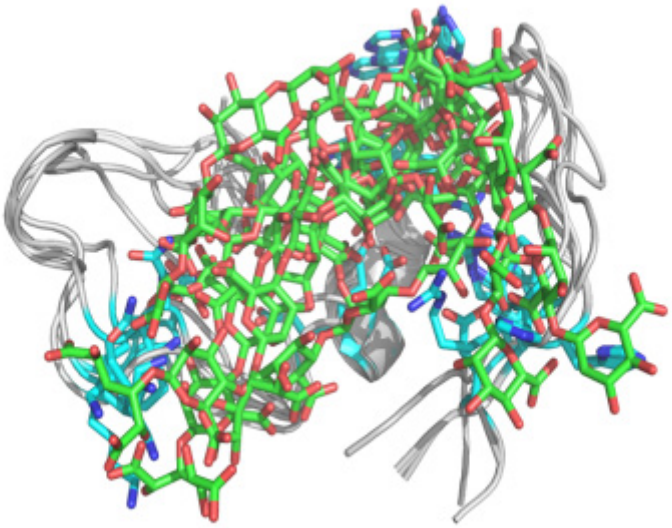
# GV-971 drug brings hope for Alzheimer's treatment

*Credit: Shanghai Institute of Materia Medica*

Sodium oligomannate (GV-971), an innovative, orally administered drug for treating Alzheimer's disease, completed its phase III clinical trial in July 2018. GV-971 is the fruit of a 21-year research effort by a team led by Prof. Geng Meiyu, principle investigator at the Shanghai Institute of Materia Medica.

The phase III trial of GV-971 met its primary endpoint of improved cognition impairment with significant statistical differences and clinical benefits. GV-971 treatment was safe and well tolerated in patients, with no statistically significant difference in adverse effects compared with the placebo group, supporting its safety for long-term use.

GV-971 is the only drug anywhere in the world to have met the endpoint of phase III clinical trials for treating Alzheimer's disease in the past 16 years. The drug was jointly developed by the Ocean University of China, the Shanghai Institute of Materia Medica and Green Valley Pharmaceutical Co., Ltd.

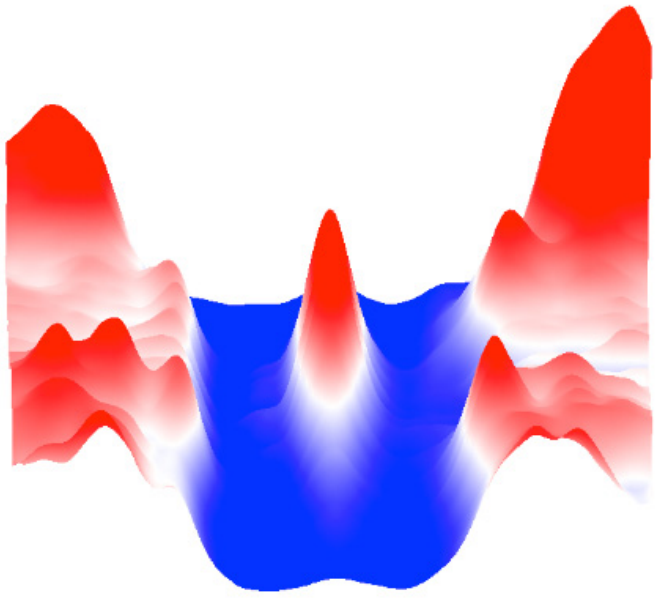


**Sodium oligomannate (GV-971)**

## Observation of Majorana bound states in Iron-based superconductor

*Credit: Institute of Physics*
*University of Chinese Academy of Sciences*

A joint research team from the Institute of Physics and the University of the Chinese Academy of Sciences has observed Majorana bound states in an iron-based superconductor for the first time. The researchers used an ultra-low temperature STM system to measure a single crystal $FeTe_{0.55}Se_{0.45}$ under high magnetic field. Pure Majorana bound states appeared in the vortex core, protected by a large topological gap and able to survive at relatively high temperature. This implies that Majorana bound states can also be found in other multiband superconductors, which enlarges the research field for Majorana excitations. This new platform does not need heterostructure fabrication, making it easier for braiding and demonstrating non-Abelian statistics. It is a major advance in building a future stable, scalable, and fault-tolerant topological quantum computer. This work was published in *Science* on Oct 19, 2018, with online publication in the same journal on Aug 16, 2018.



**Majorana bound states in an iron-based superconductor**

# China spallation neutron source and Wuhan P4 laboratory put into service

*Credit: Institute of High Energy Physics*
*Institute of Virology*

The China Spallation Neutron Source (CSNS), the country's first and the world's fourth pulsed spallation neutron source, passed national acceptance on Aug 1, 2018.

CSNS will provide a powerful platform for fundamental research and high-tech development in many fields, such as materials science and technology, life sciences, and new energy. With over 90% of its equipment manufactured in China, CSNS demonstrates world-class technical standards and experimental performance.

The Wuhan National Biosafety Laboratory of the Chinese Academy of Sciences (Wuhan P4 Laboratory) is China's first national biosafety level 4 (BSL-4) laboratory. With the capacity to engage in pathogen research at the highest biosafety level, Wuhan P4 Laboratory fills a void in China's biosafety system and helps the country play a more active role in global public health.

**Above: Wuhan P4 Laboratory**

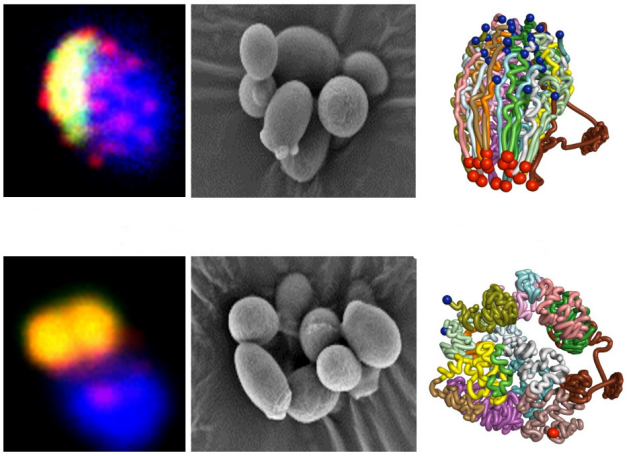
**Left: China Spallation Neutron Source (CSNS)**

## World's first artificial single-chromosome eukaryotic cell created

*Credit: Shanghai Institute of Plant Physiology and Ecology*

Qin Zhongjun, a molecular biologist at the Center for Excellence in Molecular Plant Sciences of the Shanghai Institute of Plant Physiology and Ecology under the Chinese Academy of Sciences, and his collaborators recently created the world's first eukaryotic cell containing only a single chromosome.

This is a milestone in synthetic biology. It establishes a bridge between prokaryotes and eukaryotes in genome evolution and improves our understanding of the nature of life. The research results were published online in the journal *Nature* on Aug 1, 2018.



**Right: World's first eukaryotic cell containing only a single chromosome**

Zhongke 804

# Rice molecular design breeding helps upgrade varieties in China

*Credit: Institute of Genetics and Developmental Biology*

"Zhongke 804," a new rice variety developed by CAS Academician Li Jiayang of the Institute of Genetics and Developmental Biology of the Chinese Academy of Sciences, showed excellent performance in 2018 at a 3,000-mu (200-ha) demonstration field in Heilongjiang province.

"Zhongke 804" and "Zhongke Fa" are the landmark varieties developed by Li Jiayang's team. The team won a National Natural Science First Prize in 2017 for its research, "Molecular basis underlying high-yield and superior-quality traits and breeding elite rice varieties by molecular design." Using the strategy outlined in the research, the team achieved efficient breeding of high-yield, high quality and multi-resistant rice in the two new varieties.

"Zhongke 804" is outstanding in yield, blast resistance, quality, lodging resistance and head-milled rice rate. It is a milestone in upgrading of rice varieties in China.

This research is supported by the Strategic Pioneer Science and Technology Project (Category A) "Molecular Module Design and Breeding Innovation System" of the Chinese Academy of Sciences.

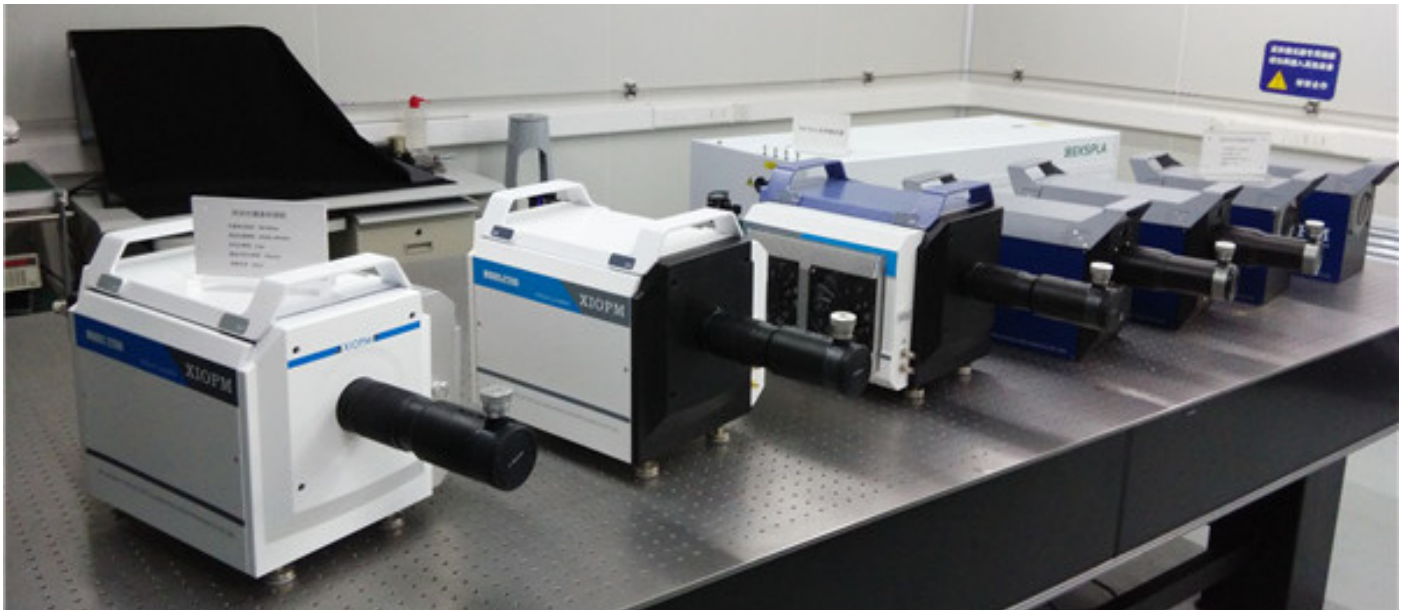
## Eight new satellites join the Beidou network

*Credit: Innovation Academy for Microsatellites*

Four pairs of Beidou Navigation System (BDS-3) satellites manufactured by the Innovation Academy for Microsatellites of the Chinese Academy of Sciences were launched into space in 2018. Each pair was launched from the Xichang Satellite Launch Center by one rocket into medium Earth orbit. The satellites have made a significant contribution to the development of the BDS-3 primary system and its global services.

Chinese President Xi Jinping mentioned this achievement – saying that the "Beidou Satellite Navigation System has gone global" – during his 2019 New Year's Message.

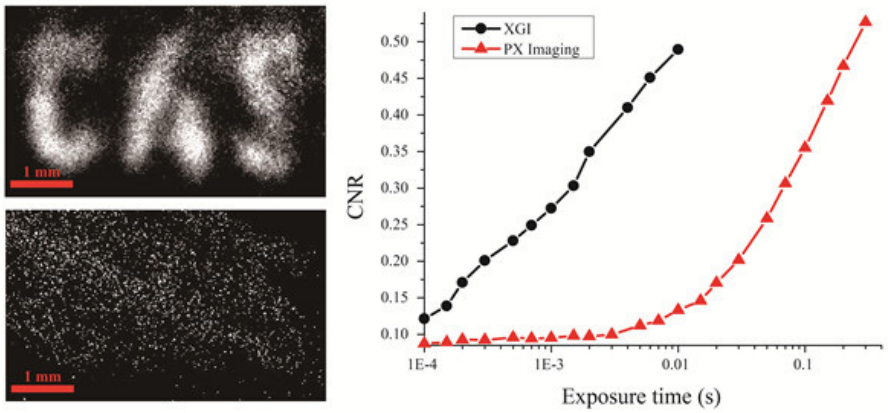
Beidou Network




**High-performance streak cameras**

# Multiple high-end scientific instruments developed

*Credit: Xi'an Institute of Optics and Precision Mechanics*
*Suzhou Institute of Biomedical Engineering and Technology*
*Institute of Physics*

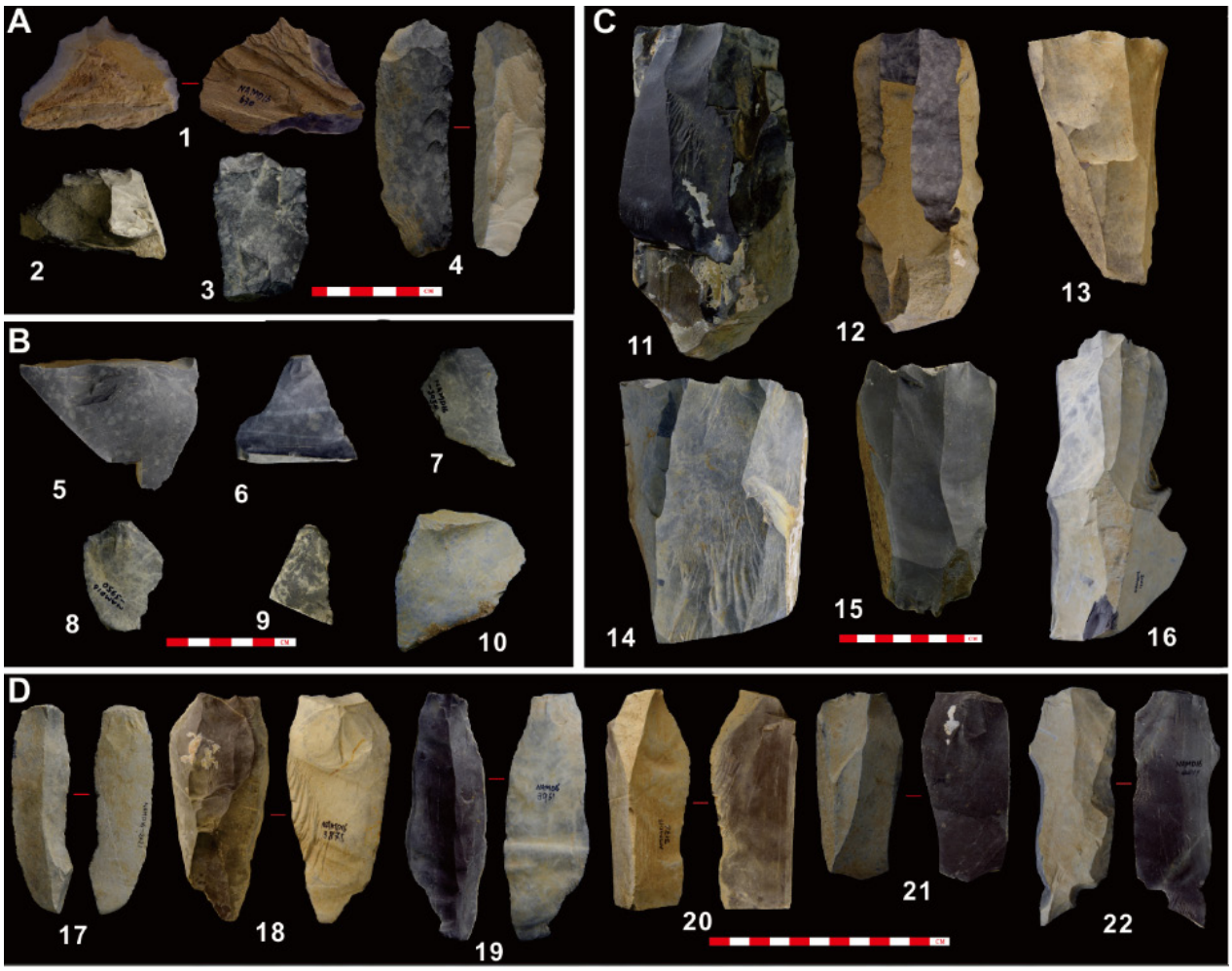



**Ultra-low dose X-ray intensity correlation imaging**

A series of high-performance streak cameras has been developed at the Xi'an Institute of Optics and Precision Mechanics of the Chinese Academy of Sciences. The series comprises eight streak cameras, including synchronous scanning, large dynamic range and femtosecond cameras. This is a breakthrough in key technologies such as the design of electronic optical systems and the production of high-performance photocathodes. These technologies have been applied in major Chinese projects.

Four kinds of high-end microscopes, including a two-photon microscope and a stimulated emission depletion (STED) microscope, were developed by the Suzhou Institute of Biomedical Engineering and Technology (SIBET) of the Chinese Academy of Sciences. The institute also developed a high numerical aperture objective lens and special excitation light source, which are used as key components in microscope systems. These developments will give a big push to China's basic research in biomedical science and upgrading of the optical microscope industry.

The Institute of Physics of the Chinese Academy of Sciences realized ultra-low dose X-ray intensity correlation imaging of two-dimensional objects and a natural biological specimen with a portable table-top X-ray source. This marks a major global breakthrough and lays the foundation for the development of a new mode of X-ray imaging and other high-tech instrumentation in China.




**Earliest human occupation**

# Earliest human occupation of Tibetan Plateau dates to 40,000 years ago

*Credit: Institute of Vertebrate Paleontology and Paleoanthropology*

The Institute of Vertebrate Paleontology and Paleoanthropology of the Chinese Academy of Sciences reported the oldest and highest early Stone Age (Paleolithic) archaeological site yet known anywhere in the world in November 2018.

This is a major breakthrough in our understanding of the human occupation and evolution of the Qinghai-Tibetan Plateau as well as larger-scale prehistoric human migrations and exchanges.

The discovery of the Nwya Devu (ND) site has yielded the earliest record of human responses to high-altitude challenges and the eventual conquest of this extreme environment.

Research results were published online in the journal *Science* on Nov 30, 2018 as: "The earliest human occupation of the high-altitude Tibetan Plateau 40-30 thousand years ago."

A reviewer said, "It is very exciting that the discovery of the ND site perfectly solved the discrepancy between genetic and archaeological data of the first human occupation on the Tibetan Plateau." In a perspective article also in *Science*, Zhang Jiafu and Robin Dennell said, "The evidence from Nwya Devu that humans were living at 4600 m above sea level 30,000 to 40,000 years ago provides a graphic example of how successful our species has been as a colonizing animal."

# Cold atomic clock in Tiangong-2 space lab

*Credit: Shanghai Institute of Optics and Fine Mechanics*
*Technology and Engineering Center for Space Utilization*

A cold atomic space clock, developed by the Shanghai Institute of Optics and Fine Mechanics of the Chinese Academy of Sciences, was launched into space with Tiangong-2. It is the first cold atomic clock in the world that is operating in orbit and carrying out scientific experiments.

During its first two years in space all scientific goals were fully achieved.


**Cold atomic clock**

The method of cooling atoms by laser beam was realized for the first time in orbit, and the clock proved its stability in space with a tolerance range of 10-16, confirming that it is the highest-precision in-orbit cold atomic clock in the world.

With this success, China has mastered the key technologies of cold atomic cooling, manipulation, interaction with microwaves and cold atomic detection in orbit. It also makes China a world leader in space-based cold atomic sensing. It is expected to advance high-precision time-frequency systems in space, and promote continuous breakthroughs in quantum physics and precision physical measurement.

The achievement was published as a highlight in *Nature Communications*.

# Breakthrough in stem cell and regenerative medicine technology and equipment

*Credit: Institute of Genetics and Developmental Biology*
*Guangzhou Institutes of Biomedicine and Health*
*Shanghai Institute of Nutrition and Health*

A healthy baby boy was born in Nanjing Drum Tower Hospital (the affiliated hospital of Nanjing University Medical School ) on Jan 12, 2018. The birth of the baby was the fruit of the world's first clinical trial to treat premature ovarian failure (POF) with umbilical cord mesenchymal stem cells combined with a collagen scaffold. This research was jointly conducted by the Reproductive Medicine Research Team of the Institute of Genetics and Developmental Biology of the Chinese Academy of Sciences (CAS) and Nanjing Drum Tower Hospital. It represents a significant breakthrough in the application of China's stem cell and regenerative medicine technology to the life sciences and health field.

**World's first clinical trial to treat premature ovarian failure (POF)**


**Automated Stem Cell Induction and Culturing System**

The research team at CAS' Guangzhou Institutes of Biomedicine and Health developed a simple, efficient and standardized method for stem cell preparation. The method offers a new scientific perspective and solution for inducing pluripotent stem cells and optimizing their preparation. The "Automated Stem Cell Induction and Culturing System" is the first automated stem cell induction culturing equipment with its own proprietary intellectual property rights, and the first automated preparation equipment for inducing pluripotent stem cells for therapeutic purposes.

Researchers from the Shanghai Institute of Nutrition and Health of CAS characterized the entire process of hematopoietic stem cell (HSC) homing in vivo and discovered a novel subpopulation of macrophages, called "Usher cells," which can recognize and guide HSC into a vascular niche. This work was published as a cover story in *Nature* on Dec 6, 2018, and provides new insights into improving the efficiency of HSC transplantation.